X. *An Account of the larger and lesser Species of Horse-shoe Bats, proving them to be distinct; together with a Description of Vespertilio Barbastellus, taken in the South of Devonshire. By George Montagu, Esq. F.L.S.*

Read November 19, 1805.

Most naturalists have conceived an opinion that there are two varieties of the Horse-shoe Bat, *Vespertilio Ferrum-equinum*, distinguished only by their size; as such, Gmelin quotes the *major* and *minor* of Schreber.

The larger species only has hitherto been noticed in England. This was originally discovered by Doctor Latham, who communicated it to Mr. Pennant, and he first made it public in his *British Zoology*, where he states it to be found in the saltpetre houses belonging to the powder-mills at Dartford, frequenting those places in the evening for the sake of gnats; and also observed during winter in a torpid state, clinging to the roof. It is described thus: "The length from the nose to the tip of the tail is three inches and a half: the extent fourteen. At the end of the nose is an upright membrane in form of a horse-shoe. Ears large, broad at their base, inclining backwards, but want the little or internal ear. The colour of the upper part of the body is a deep cinereous; of the lower whitish."

Doctor Shaw, in his *General Zoology*, has nearly followed Mr. Pennant, but adds, "There is said to be a greater and smaller variety;

variety; perhaps the male and female: the greater is above three inches and a half long from the nose to the tip of the tail: the extent of the wings above fourteen."

With respect to the smaller Horse-shoe Bat, nothing more appears to be known than that it is inferior in size, but in other respects similar; from which may be inferred that it is very little known, and it has not, to my knowledge, been recorded as indigenous to England. It is therefore with no small degree of satisfaction I have to announce, that it is by no means uncommon in particular situations; and I have the pleasure of congratulating the zoologist, that fortunate circumstances have enabled me to put the long unsettled opinion with respect to these two Bats, beyond all possible doubt; having lately taken a considerable number of both species, in each of which the sexual distinction was evident. But to render the subject more clear and incontrovertible, I shall proceed, by giving a description of the lesser species, and endeavour clearly to define the characteristic distinction between these two very analogous animals. In order, however, to prevent future confusion, I propose that the least of these should be called *Vespertilio minutus*, leaving the other in full possession of the original Linnæan trivial name of *Ferrum-equinum*.

VESPERTILIO MINUTUS.

Length scarcely two inches and three quarters from the tip of the nose to the end of the tail, of which the latter is full three fourths of an inch: extent of the wings nine inches and a half: weight from one dram three grains, to one dram twenty grains.

The colour above is pale rufous-brown, most rufous on the upper part of the head: the nose is surrounded on the top with a broad membrane somewhat in form of a horse-shoe; within

this is a smaller, in which the nostrils are placed; between these are two other small membranes standing a little obliquely, and appearing as valves to the nostrils; behind these stands a much more elevated longitudinal membrane; and further back is another transversely placed, of a pyramidal shape, standing erect behind the eyes; these last are covered slightly with hair, and some long bristles: round the upper lip under the exterior membrane of the nose is a row of minute tubercles, each furnished with a small bristle, equally well calculated to guide the lesser winged insects to the mouth, as the *vibrissæ pectinatæ* observed in several species of birds: the eyes are very small, black, and hidden in the fur: the ears large, pointed, and turned a little back at their tips; their base almost surrounds the opening, but at the outer part in each is a notch, which admits of the fore part of the ear closing within the other as a substitute for a valve so common in most other species, but of which this is destitute.

It is now many years since I first noticed this species of Bat in Wiltshire; once, in particular, I recollect to have seen a great many taken in the winter over the hollow of a baker's oven, having got in through a small external fissure. In the year 1804, about the latter end of the month of May, I observed several in an old building at the verge of a wood at Lackham, in the same county, erected for the shelter of cattle. In this shaded dark abode, surrounded by lofty oaks, it is not unusual to see several adhering to the plastered roof by their hind claws; and when approached, generally crawling a little to one side, and showing signs of uneasiness by moving their heads about in various directions, but not seeming inclined to take flight till they have been repeatedly disturbed.

At this time I had not been fortunate enough to discover the

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haunt of *Vespertilio Ferrum-equinum;* but my wishes have since been amply gratified, by taking nine of the *V. Ferrum-equinum*, and seven of the *minutus*, many of which were conveyed home alive: of the former there were four males and five females; of the latter five males and two females. Of the *V. Ferrum-equinum* the largest and smallest were both females, one preponderating four drams and a half, the other not exceeding four drams. The length of these to the setting on of the tail two inches and a half; to the end of the tail three inches and three quarters: the expansion of the wings about fourteen inches and a half.

In colour these two species are perfectly similar, except in some instances the sides and breast of the *V. Ferrum-equinum* are more of a ferruginous-brown.

With respect to the face, which is so extremely curious, there appears on a cursory view scarcely a perceptible difference, except that the upper lip of the *V. Ferrum-equinum* is much more tumid; but the most material distinction is in the formation of the nasal membranes, especially that which is posterior and transverse. To explain this no words can convey what a simple outline will, and therefore the curious are referred to TAB. XVIII. *fig.* 5. which represents the side view of the membranes of *V. Ferrum-equinum*, of which *a* is the posterior transverse one; the front is seen at *fig.* 6. The same views are given of the nasal membrane of *V. minutus* at *fig.* 7. and 8, where *b b* represent the membranes in different points of view. In these a very striking difference is observable, and it will also be perceived that the anterior longitudinal membrane is by no means similar in both species.

With respect to the teeth, it will be observed that the *V. Ferrum-equinum* possesses two minute distant fore teeth in the upper

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jaw, which are not to be found in the *V. minutus*; a circumstance that seems to have escaped most naturalists, this genus being usually placed in the division destitute of upper fore teeth: the canine teeth are also much stronger in proportion in *V. Ferrum-equinum* than in the other species.

Linnæus, when he placed the Bats in the first order of *Mammalia*, doubtless considered the whole genus to agree in possessing two pectoral teats, and no others; and that opinion seems to have been confirmed by succeeding naturalists as far as treading in the path of so great a physiologist may be considered as a proof of the fact. It must, however, be acknowledged that we should do well, if, at the same time we admire the wisdom and consummate skill of others, we were to recollect that circumstances do not always concur to throw all the light upon a subject that might be desired, and that the wisest and most skilful philosopher is not proof against mortal fallibility.

Those who are in the habit of searching minutely into the secrets of nature, well know how necessary it is to be cautious in admitting of general rules.

That the appearance of two pectoral teats in the Bat genus, without any others contiguous, should lead to a conviction that they were the only papillæ such animals possessed, may easily be conceived; but chance frequently develops what the most scrutinizing eye has sought for in vain.

While I was searching for some curious insects which were observed to move with unusual celerity amongst the fur of these Bats*, the pectoral papillæ of one of the *V. minutus* were very conspicuous by the space round them being bare, as if the animal had recently suckled its young; and to my utter astonishment, on turning the fur over in every direction, I discovered two other

* *Celeripes Vespertilionis*, a newly discovered insect.

teats

teats very near together, situated on the lowest part of the abdomen, close to the *pubis*. It may readily be imagined that so unexpected a discovery scarcely admitted the senses to determine the validity of ocular demonstration; the aid, however, of glasses left no doubt of the fact, and a scientific friend confirmed my opinion. At the moment of this discovery I had emboweled all the specimens of *V. Ferrum-equinum*, and consequently cannot determine whether they are similarly formed or not; nor have I since procured a female Bat of any other species to examine, so that it yet remains to be ascertained whether this structure is peculiar to one or more species, or that the two abdominal papillæ are really essential to the generic character of these animals, but hitherto overlooked, by being so far removed from the others. On future observation must depend the place to which the Bats should be properly consigned in the systematic arrangement of quadrupeds. If some species only are found to possess four papillæ, it would be a very considerable violence to nature to divide them on that account; and yet to retain them undivided in the order of *primates*, according to the Linnæan definition, would be inconsistent: but on this part of the subject there is no necessity of enlarging until we become more enlightened.

It is probable the papillæ of all the smaller Bats are so contracted, except at the time of administering nourishment to their young, that they are not discoverable with the utmost attention, for even in the *V. Ferrum-equinum* no pectoral teats were to be discovered, although the sexual distinction was sufficiently evident. But this very contracted state of those parts, when nature has no demand for the use assigned to them, is not peculiar to these volant quadrupeds, since we find the same difficulty in discovering them in mice.

These Bats were taken in a large cavern near Torquay in Devonshire,

vonshire, commonly known by the appellation of Kents-hole, and where both species are usually observed in considerable abundance clinging to the vaulted roof of the interior apartments. This vast cavern was explored with a view to obtain whatever species of *Vespertilio* might inhabit it, and with expectation of procuring specimens of *V. Barbastellus*, and possibly some new species, having been informed the cave abounded in number and variety. Strange, however, as it may appear, not a single instance occurred of any other species becoming an inhabitant of this dark and frightful region.

It should therefore appear that these two Bats are as congenial in their animal temperature, as they are similar in habit; and that in constitution they essentially differ from all the other British species.

It is well known that all places impervious to light, and destitute of a free circulation of air, can neither be suddenly heated nor suddenly cooled by the changes of atmospheric temperature, and that the vicissitudes of such a climate are extremely small: thus these species from instinct seek those dark and dreary abodes, and wholly retire from the face of day, their feelings being repugnant to the benign influence of the solar rays, which vivifies and reanimates all nature besides.

The *V. Noctula*, *murinus*, *auritus*, and probably *Barbastellus*, whose constitutions appear more robust, do not retire into total darkness, nor wholly remove from the vicissitudes of the surrounding atmosphere; but, being formed by nature to bear a greater degree of either heat or cold, content themselves with such a hybernaculum as is sufficient to protect them equally from the extremes of one or the other. Thus we find these in the fissures of old buildings, in towers, under the eaves of houses and churches, and in the hollows of trees, and not unfrequently congregated;

congregated; but they seldom or never enter those gloomy regions which nature has consigned to the others as an exclusive right of inheritance.

Contemplating the frolics and evolutions of these little creatures in our summer evenings perambulations, must bring to recollection the extraordinary opinion of some philosophers, who scarcely admit their progressive motion to be an act of flying. How little can such have attentively observed their sudden and rapid turns in pursuit of flies! It might be fairly asked, How much inferior are the aërial excursions of a Bat to that of a swallow, one of the most powerful on wing of the feathered tribe? and might we not pronounce, without risk of refutation, that a Bat far surpasses the greater part of birds in its powers of flight?

If we are to give the utmost credit to the experiments of Spalanzani and M. de Jurine, the conclusion would be, that vision is not of any apparent use to these animals, since they fly about with as much ease, and equally avoid obstacles, when their eyes are covered, or even put out, as they do previous to that operation. That their eyes, being minutely small, are not calculated to admit many rays of light, as in most nocturnal birds, must be allowed, but then they have no occasion to distinguish their prey at a distance. If it be denied that their eyes are of any use in the discerning of objects against which they might strike, surely they must be equally useless in discovering the smaller winged insects on which they prey in the dusk of the evening.

Can we, however, meditate on the wonderfully rapid turns and evolutions of these creatures in pursuit of their prey, and not allow them the powers of sight to effect the first principle of life, a power not denied to any known animal possessed of a red

circulating fluid by the arterial system? To assent to the conclusion which M. de Jurine has drawn from his experiments, that the ears of Bats are more essential to their discovering objects than their eyes, requires more faith, and less philosophic reasoning, than can be expected of the zootomical philosopher, by whom it might fairly be asked, Since Bats see with their ears, do they hear with their eyes? It will not be sufficient for these experimentalists to inform us that the copious auricles of this class of animals, or their delicate internal structure, are adequate to the double purpose of seeing and hearing, when we perceive that they are by nature provided with organs of sight similar to what we not only feel most sensibly to be the most inestimable of blessings, but also perceive to be the principal fountains of locomotion in all other animals in the same scale of beings.

Although it cannot be admitted that the Almighty hand gave to these creatures those most wonderfully constructed organs of sight, without endowing them with visual properties, yet it must be allowed that there is something extremely astonishing and unaccountable in their unembarrassed flight in total darkness, whether by sealing up their eyes, or by their natural habits, of finding their way through all the smaller passages and windings, into the inmost recesses of their subterraneous abode. By what occult property they direct their course in total darkness, is perhaps a problem of as difficult solution as that of a swallow returning from the torrid to the frigid zone, to breed in the same nest it had prepared the preceding year, and in which it had performed those functions of nature. Can any human understanding develop the cause that so unerringly directs the carrier-pigeon to its place of nativity, when previously taken to the distance of five hundred miles? How is the bee instructed

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to find its hive when captured and taken to a distance? This is inexplicable, and yet no one will dispute the fact. Indeed the practice is common in some countries, in order to find the wild hives; for if two bees are taken near the same spot, and turned out at different points, distant from each other a few hundred yards, if belonging to the same hive, the two lines formed by the direction of their flight will discover the hive to be at the intersection of those lines. These are the mysteries of nature, so impenetrable to the human mind, that we are lost in a labyrinth of wonder at such instinctive endowments, which are incomprehensible to our limited faculties. We have only attentively to examine the operations of nature, and we shall find a thousand instances not less astonishing than that the Bat should find its road without one single ray of light to direct its course*.

VESPERTILIO BARBASTELLUS.

Gmel. Syst. i. *p.* 48. *Buffon.* viii. *p.* 130. *t.* 19. *f.* 1.
Pennant Quadr. ii. *p.* 561. *Shaw Zool.* i. *p.* 133.
Brit. Miscellany, *t.* v.

This species has long been known to be an inhabitant of some parts of the European continent, especially France, but, I believe, had not been discovered to inhabit England till the year 1800, when I first noticed it to be indigenous to the south of Devon, and had prepared an account of it for the Linnean Society. Since that period others have occurred in the same

* Since the preceding account was written, several of both these species of Bats have been collected from the same cavern, and in one of the *V. minutus* the abdominal papillæ were more conspicuous than in the former; but not the least vestige of such could be found in the *V. Ferrum-equinum:* it should, however, be remarked, that in these the pectoral teats were equally invisible.

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county; and we are informed in the *British Miscellany*, that it has been taken in the powder-mill at Dartford in Kent.

The figure and description given in that work are highly satisfactory; but as it is a newly discovered quadruped in this island, and of course little known, it may not be uninteresting to give some additional description of it from specimens in my possession, and to make such further remarks as may conduce to its natural history.

The first I obtained was taken on wing in the village of Milton, which is situated near the coast, and, I believe, was a female.

The colour of this is a dusk-black, intermixed with a few gray-brown hairs towards the rump: the membranes of the wings and tail dusky.

On the 17th of August 1805, I procured a male specimen alive; it was found adhering to a small tree near Kingsbridge.

The length is nearly four inches, of which the tail measures one inch seven eighths; the extent of the wings about eleven inches: weight exactly one hundred grains.

The colour differed a little from that of the former, especially in having the middle of the back and the breast mixed with silvery-gray hairs; the lower belly, thighs, and behind the vent on the tail membrane more gray. The nose is rounded in front, flat, and cavernous on the top, in which part the nostrils are placed: ears large and black, furnished with a linear valve, and unusually broad at the base, extending forwards, and meeting over the nose, so as to cover the forehead: eyes very small, seated within the membrane of the ear: the teeth numerous in both jaws, and much jagged; in the upper, four cutting teeth, but no canine, and a vacant space between those and the grinders: in the lower jaw six cutting teeth, and four canine or longer teeth, and between these last on each side is a small inter-

mediate one; these longer teeth fall into the vacant space in the upper jaw.

Buffon appears to be the first naturalist who recorded this species, and his account of it has been copied by succeeding writers.

It seems to partake of the habits of the common Bat; but it may be readily distinguished from *Vespertilio murinus*, even on wing, in the earlier part of the evening, by its superior size, and in being by far the darkest in colour of all the British Bats. Upon comparison, the flattened nose, more pointed ears, and particularly the base of these coming so forward on the forehead as scarcely to leave any space between, will be found essential characters of distinction.

I have not been able to discover the hybernaculum of this species, but it is reasonable to believe its torpid state is passed in similar situations to those in which all but the *V. Ferrum-equinum* and *V. minutus* retire during the colder months; none of which appear to be subterraneous.

XI. *De-*